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Apparatus for locating an elbow prosthesis.

Abstract:

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An elbow prosthesis (41, 60, 82) and a jig (1) for ensuring accurate placement of same is described. The jig (1) is accurately located around the patient's elbow and using a first selected tool holder the humerus is prepared with a convex end from the medial side. Without moving the jig (1), a complementary concave end is prepared in the ulna using a second selected tool holder. The radius is prepared, from the lateral side of the elbow, with a straight cut. The humeral portion (41) of the prosthesis is slid into place over the convex end of the prepared bone, the ulna portion (60) of the prosthesis is secured by pinning to the concave end of the prepared bone and the radial portion (82) of the prosthesis is secured to the straight end of the radius by pinning thereto and the thickness thereof is adjusted to provide proper articulation clearance with the humeral portion (41).

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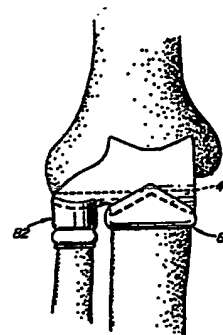
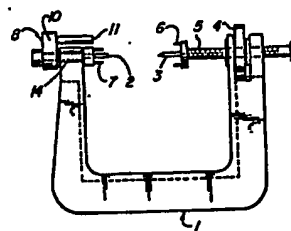
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54 **Elbow prosthesis.**

57 An elbow prosthesis (41, 60, 82) and a jig (1) for ensuring accurate placement of same is described. The jig (1) is accurately located around the patient's elbow and using a first selected tool holder the humerus is prepared with a convex end from the medial side. Without moving the jig (1), a complementary concave end is prepared in the ulna using a second selected tool holder. The radius is prepared, from the lateral side of the elbow, with a straight cut. The humeral portion (41) of the prosthesis is slid into place over the convex end of the prepared bone, the ulna portion (60) of the prosthesis is secured by pinning to the concave end of the prepared bone and the radial portion (82) of the prosthesis is secured to the straight end of the radius by pinning thereto and the thickness thereof is adjusted to provide proper articulation clearance with the humeral portion (41).



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ELBOW PROSTHESIS

This invention relates to an elbow prosthesis and apparatus for locating the prosthesis in an elbow joint.

There are numerous medical conditions which can only
5 be successfully treated by the surgical replacement of an
entire elbow joint with a prosthetic device. While the elbow
is a relatively simple hinge joint, the surgical replacement
thereof is, nevertheless, not without its problems. Firstly,
the prosthesis must be extremely accurately located in both
10 the humerus and ulna, and secondly, the joint must be separated
to allow the surgeon room to prepare the ends of the ulna and
humerus to receive the prosthesis. If the joint is separated
and each bone treated independently of the other, accuracy in
locating the prosthesis tends to suffer and furthermore it is
15 relatively difficult to separate the joint sufficient to permit
access to the bone ends without causing ligament or soft tissue
damage. It is therefore an object of the present invention to
provide a simple elbow prosthesis which can be inserted from the
side, thereby eliminating the need to separate the elbow joint.

20 It is another object of the invention to provide a
novel means to cut away the bone, from the medial side, to prepare
with extreme accuracy the site in both the ulna and humerus to
receive the prosthesis.

Thus by one aspect of this invention there is provided
25 an elbow prosthesis comprising:

(a) a first longitudinally extending metallic element,
substantially C-shaped in cross section so as to provide
concave and convex surfaces, for insertion so that said concave
surface thereof is in abutting relation with a convexly

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prepared lower end of a humeral bone, said convex surface providing smooth first and second articulating surfaces, and longitudinally extending pin means parallel said concave and convex surfaces for securing said element in said humeral
5 bone;

(b) a second longitudinally extending element, substantially C-shaped in cross section so as to provide concave and convex surfaces for insertion into abutting relation, by said convex surface, with a concavely prepared upper end of
10 an ulna bone, pin means to secure said second element to said ulna bone, a thermoplastics element releasably engageable with said concave surface of said second element and having a concave surface contoured for articulation with said first smooth articulating surface of said first element; and

15 (c) a third, planar, element for insertion into abutting relation with a planar prepared upper end of a radial bone, means to secure said planar element to said radial bone, a second thermoplastics element having a smooth concave surface for articulation with said second smooth articulating surface
20 of said first element, adjustably mounted on said planar element, and means for varying the spacing between said second smooth thermoplastics element and said planar element so as to adjust articulation between said second thermoplastics element and said second articulating surface.

25 By another aspect of the invention there is provided a guide device for accurately locating saw cuts preparatory to implantation of an elbow prosthesis, comprising:

(a) U-shaped frame member dimensioned to receive a patient's elbow between the arms thereof, and means to

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clampingly engage said frame to said elbow at a selected position thereon;

(b) guide means oscillatable about an axis coincident with the axis of said clamping means whereby a cutting tool, 5 rotatable in said guide means, may be oscillated arcuately about said axis at a selected distance therefrom; and

(c) planar guide means releasably engageable with said frame in a plane perpendicular to said axis, including an arcuate slot disposed at a selected distance from said 10 axis to receive a rotatable cutting tool for oscillatory motion therein.

The invention will be described in more detail herein- after with reference to the drawings in which:-

Figure 1 is a side view of a clamp according to the 15 present invention;

Figure 2 is an end view of a humerus guide;

Figure 3 is an end view of an ulna guide;

Figure 4 is a side sectional view of a humeral prosthesis;

20 Figure 5 is an end view of the prosthesis of Figure 4;

Figure 6 is a side sectional view of an ulna prosthesis;

Figure 7 is an end view of the prosthesis of Figure 6;

Figure 8 is a side view of a radial prosthesis;

Figure 9 is a sectional view of the complete prosthesis 25

Figure 10 is a medial view of the right elbow of Figure 9; and

Figure 11 is a lateral view of the right elbow of Figure 9.

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With reference, firstly, to Figure 1, there is shown a U-shaped frame 1, which is used to accurately locate the cutting device on the patient's elbow. Prior to installing the frame on the humerus, a small relatively shallow locating hole 5 is drilled in each side of the humerus at carefully selected positions adjacent but above the lower end thereof using known techniques for location. Pins 2 and 3 are positioned in the locating holes so as to position the frame with pin 3 being on the lateral side of the elbow. The frame is secured in place 10 around the elbow by tightening knurled nut 4, which drives threaded rod 5 forward so that pins 6, 7 are driven into the humerus. Locating pin 2 on the medial side can then be withdrawn and replaced with humerus burr guide 8. Burr guide 8 comprises a pin 9 mounted perpendicular to the body 10, and a hollow pin 11 15 axially parallel to and spaced a selected distance from pin 9. Pin 11 is adapted to receive a rotatable burr (not shown) and to oscillate through an arc about the axis of pin 9. The burr may be rotated by a convenient power or air tool as is conventional in an operating theatre. Oscillation of the burr about 20 the axis of pin 9 causes removal of the end of the humerus with an extremely accurately drawn semi-circular cut, so that in end view the end of the humerus presents a convex surface.

Humerus burr guide 8 can now be removed, without disturbing the frame 1, and replaced by ulna guide 12 (Figure 3). 25 Ulna guide 12 comprises a pin 13, which is insertable in hole 14 or frame 1, and a plate 15 perpendicular thereto having an arcuate slot 16 therethrough. Slot 16 is spaced a selected radial distance from pin 13 so as to provide the exact spacing required between the humerus and ulna to receive the prosthesis,

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to be described in more detail hereinafter, when the end of the ulna has been removed. A rotary burr (not shown) is inserted through slot 16 and moved arcuately from end to end thereof so as to cut off the end of the ulna and provide a concave surface therein. The frame 1 can now be removed from the patient's elbow, and a further incision made from the lateral side of the elbow so as to expose the end of the radial bone. The entire tip of the radial bone is then removed to provide a flat square end thereto to receive the radial prosthesis to be described in more detail hereinafter.

It will be appreciated that, in certain circumstances, frame 1 can be removed before making the ulna cut and the ulna guide 12 may be attached directly to the elbow solely by means of pin 13.

15 Figures 4 and 5 illustrate the humeral element of the prosthesis, and show an elongated semi-cylindrical metallic prosthesis 41, formed from any suitable non-allergenic and biocompatible alloy such as "Vitallium[®]". Preferably, but not essentially, the prosthesis is a precision investment casting. 20 In cross-section the prosthesis 41 is substantially semi-circular as seen in Figure 5 the outer convex surface 42 is highly polished and provides the articulating surfaces 43, 44 for contact with the ulna and radial prosthetic elements respectively as described in more detail hereinafter. The 25 inner concave surface is preferably coated with a porous ceramic coating material in order to promote bone ingrowth in a manner known per se. The prosthesis is press fitted from the medial side onto the convex cut end of the humerus and located by means of axial pin 45 which is inserted in the hole drilled to receive

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pin 2 initially.

The complementary ulna prosthetic element 60, shown in Figures 6 and 7 comprises a curved stainless steel, such as Vitallium[®], shell 61 having a porous ceramic coating 62 on the 5 convex surface thereof and a high density polyethylene (HDPE) layer 63 on the concave surface thereof. The HDPE layer 63 is convexly contoured (medial view) to complement the concave portion 43 of prosthesis 42, and to articulate smoothly therewith. The HDPE layer 63 is arranged to snap fit into the steel backing 10 shell 61, for easy installation, removal and replacement as necessary. The shell 61 is secured against the ulna by means of a stainless steel pin or screw 64 which is driven or screwed longitudinally into the end of the ulna, or by any other conventional fastening.

15 As noted above, the tip of the radial bone 81 is removed through an incision from the lateral side of the elbow, and replaced by a radial prosthesis element 82 comprising an HDPE concave (in cross section as shown in Figure 8) surfaced block 83, contoured to articulate with convex surface 44 of 20 prosthesis 42, mounted on a steel ("Vitallium" type) plate 84 by means of bolt 85. Block 83 and plate 84 are adjustable, relative to base plate 86 which is rigidly secured to radius 81 by bone pins 87, 88 and central bore 89 which is provided with fins 90, an intermediate resilient pad 91 the thickness 25 of which may be adjusted by tightening or loosening plate 84 in its screw mounting 92 through plate 86. Adjustment of block 83 relative to plate 86 is necessary to provide proper articulation spacing between the concave surface 93 on the radial portion of the prosthesis and convex surface 44 on the

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humeral portion of the prosthesis, as illustrated in Figures 9, 10 and 11. Threaded bores 94 and 95 are provided in block 83 and plate 86 to receive lock screws (not shown) to secure the correct spacing and prevent relative movement after completion of the surgery.

CLAIMS

1. An elbow prosthesis comprising:
- (a) a first longitudinally extending metallic element, substantially C-shaped in cross section so as to provide concave and convex surfaces, for insertion so that said concave
- 5 surface thereof is in abutting relation with a convexly prepared lower end of a humeral bone, said convex surface providing smooth first and second articulating surfaces, and longitudinally extending pin means parallel said concave and convex surfaces for securing said element in said humeral bone;
- 10 (b) a second longitudinally extending element, substantially C-shaped in cross section so as to provide concave and convex surfaces for insertion into abutting relation, by said convex surface, with a concavely prepared upper end of an ulna bone, pin means to secure said second element to said
- 15 ulna bone, a thermoplastics element releasably engageable with said concave surface of said second element and having a concave surface contoured for articulation with said first smooth articulating surface of said first element; and
- (c) a third, planar, element for insertion into abutting
- 20 relation with a planar prepared upper end of a radial bone, means to secure said planar element to said radial bone, a second thermoplastics element having a smooth concave surface for articulation with said second smooth articulating surface of said first element, adjustably mounted on said planar
- 25 element, and means for varying the spacing between said second smooth thermoplastics element and said planar element so as to adjust articulation between said second thermoplastics element and said second articulating surface.

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2. A prosthesis as claimed in claim 1 wherein said concave surface of said first element, said convex surface of said second element and said means to secure said third element are each provided with a porous ceramic coating so as to promote bone
5 in-growth.

3. A prosthesis as claimed in claim 2 wherein said first metallic element is fabricated from stainless steel and said thermoplastic second and third elements are fabricated from high density polyethylene.
10

4. A guide device for accurately locating saw cuts preparatory to implantation of an elbow prosthesis, comprising:

(a) U-shaped frame member dimensioned to receive a patient's elbow between the arms thereof and means to clampingly
15 engage said frame to said elbow at a selected position thereon;

(b) guide means oscillatable about an axis coincident with the axis of said clamping means whereby a cutting tool, rotatable in said guide means, may be oscillated arcuately about said axis at a selected distance therefrom; and

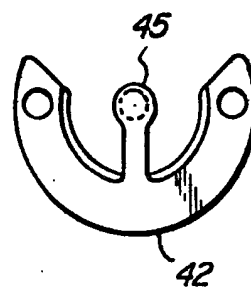
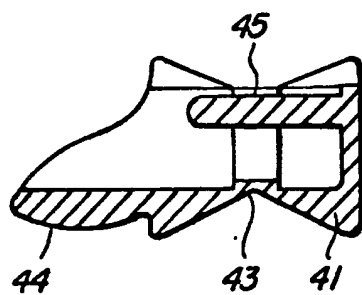
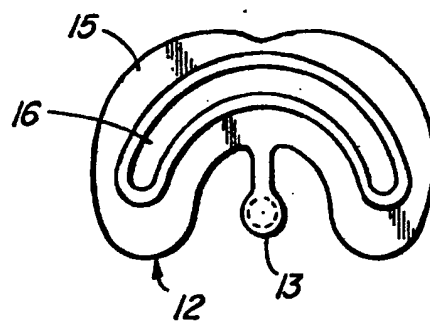
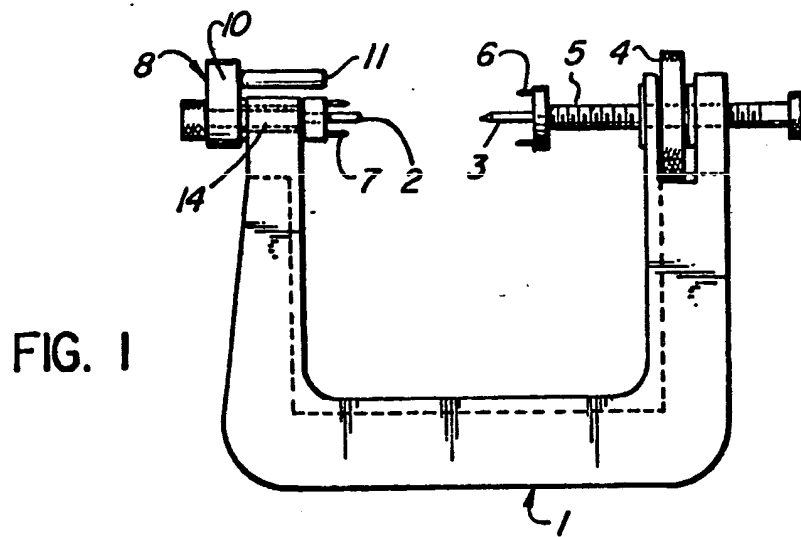
20 (c) planar guide means releasably engageable with said frame in a plane perpendicular to said axis, including an arcuate slot disposed at a selected distance from said axis to receive a rotatable cutting tool for oscillatory motion therein.

25 5. A guide device as claimed in claim 4 wherein said clamping means includes retractable pin means for insertion into locating holes drilled in the humeral bone of said elbow.

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6. A guide device as claimed in claim 4 wherein said guide means is arranged to receive a humeral bone cutting rotatable burr.

7. A guide device as claimed in claim 4 wherein said
5 planar guide means is arranged to receive an ulna bone cutting rotatable burr.



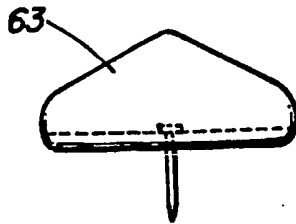


FIG. 6

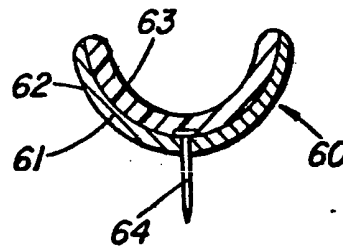


FIG. 7

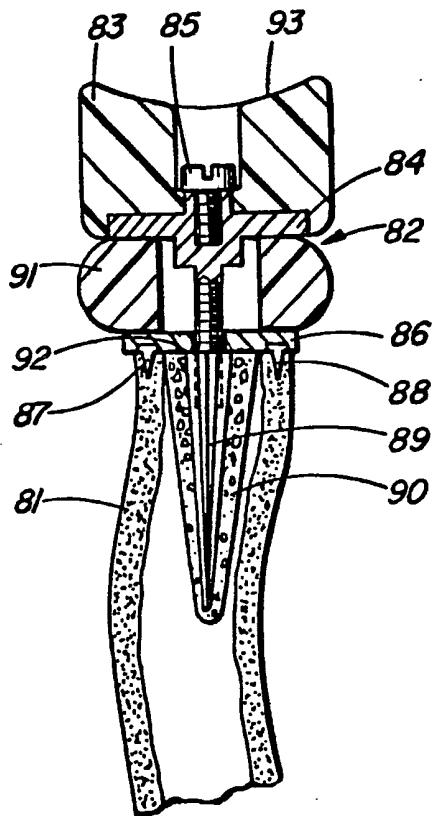


FIG. 8

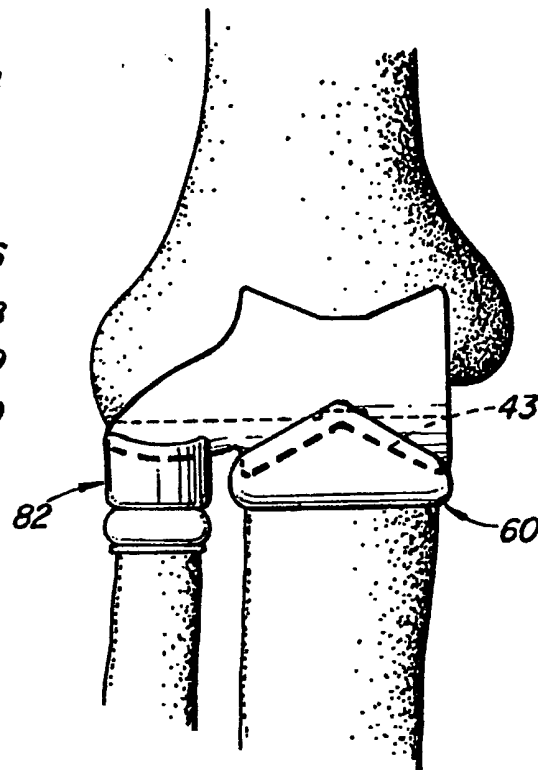
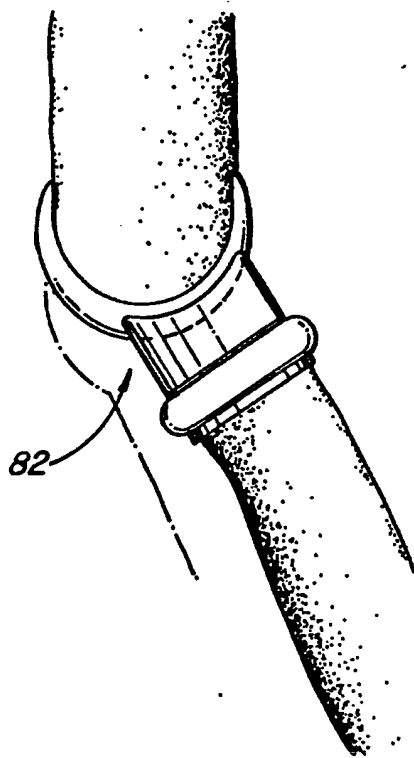
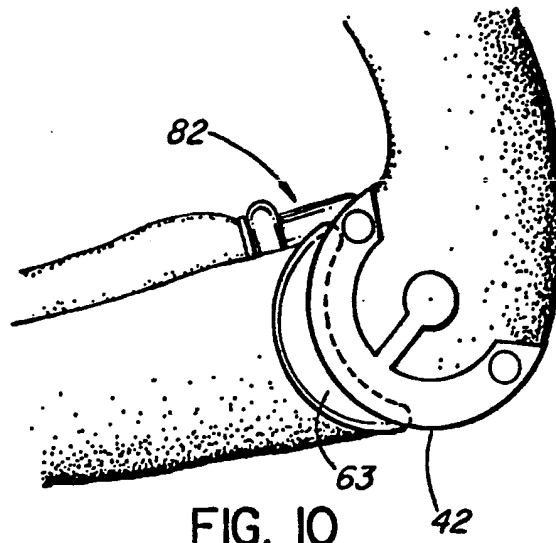


FIG. 9



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European Patent
Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 84303951.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
A	<p><u>GB - A - 1 601 576</u> (HONMEDICA INT. INC.)</p> <p>* Fig. 4-11, 12-15, 17-20; page 4, lines 27-43, lines 110-112; page 4, line 129 - page 5, line 3; page 5, lines 25-29, 65-68, 105-115 *</p> <p>--</p>	1, 3	<p>A 61 F 2/38</p> <p>A 61 F 2/46</p> <p>A 61 B 17/00</p>
A	<p><u>GB - A - 2 022 422</u> (T.G. WADSWORTH)</p> <p>* Totality *</p> <p>--</p>	1, 3	
A	<p><u>US - A - 4 383 337</u> (R.G. VOLZ et al.)</p> <p>* Totality *</p> <p>--</p>	1	
A	<p><u>GB - A - 2 104 392</u> (SOUTH AFRICAN INV. DEV.)</p> <p>* Fig. 2; page 3, lines 46-71 *</p> <p>----</p>	4, 5	<p>TECHNICAL FIELDS SEARCHED (Int. Cl. 7)</p> <p>A 61 F 1/00</p> <p>A 61 B 17/00</p>
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 25-10-1984	Examiner LUDWIG
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p> <p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			